Transport Canada Transports Canada

TP 1624

Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

Canada

Ce rapport est aussi disponible en français.

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE CAPSIZE AND LOSS OF THE CANADIAN FISHING VESSEL "SAMWISE" OFF THE WEST COAST OF VANCOUVER ISLAND, B.C., SEPTEMBER 1, 1987.

REPORT No. 495

These sections of the Investigation Report prepared pursuant to Section 542, or of the Preliminary Inquiry Report prepared pursuant to Section 545, of the Canada Shipping Act, are released for accident prevention purposes only and are confined to cause-related circumstances.

This report and its contents may be deficient and misleading if used in any other process and are not to be used or admitted in evidence in any legal proceedings, either civil or criminal, arising out of the casualty described in the report. The statements, opinions and findings in the report are those of the Marine Casualty Investigations Division only and do not constitute admissions made by or on behalf of Her Majesty the Queen in right of Canada.

Ces sections du rapport d'investigation ou du rapport préliminaire sont rédigées en vertu des articles 542 et 545 respectifs de la Loi sur la marine marchande du Canada et ne sont publiées qu'à des fins de prévention des accidents seulement et ne portent que sur les circonstances entourant le cas à l'étude.

Ce rapport et son contenu peuvent être insuffisants et trompeurs s'ils sont utilisés à d'autres fins et ne peuvent être utilisés ou acceptés comme preuve dans quelque procédure que ce soit, au civil ou au criminel, même si ces procédures découlent de l'accident décrit dans ledit rapport. Les déclarations, les opinions et les constatations de ce rapport appartiennent uniquement à la section des Enquêtes sur les accidents maritimes et ne constituent pas une acceptation de la part ou au nom de Sa Majesté du chef du Canada.

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE CAPSIZE AND LOSS OF THE CANADIAN FISHING VESSEL "SAMWISE" OFF THE WEST COAST OF VANCOUVER ISLAND, B.C., SEPTEMBER 1, 1987.

Particulars of Vessel

Name	"SAMWISE"
Official Number	392966
Port of Registry	Vancouver, B.C.
Call Sign	CY3144
Gross Tonnage	99.04
Net Tonnage	41.27
Length O.A.	23.63 m
Breadth Mld.	7.01 m
Depth Mld.	3.58 m
Draughts (At time of Incident)	F: 3.48 m A: 3.75 m
Type	Built as a longliner
Built	1979, Vancouver, B.C.
Propulsion	Two Volvo Penta diesel engines developing 402 kW and driving a single shaft with a variable pitch propeller
Bowthruster	Hydraulic, 0.66 cm diameter
Cargo	13.6 t (tonnes) frozen bait, 4.06 t shaved ice, approximately 52 t of catch preservation seawater
Crew	9
Owner/Operator	Donald Charles Yorke, Campbell River, B.C.

Navigating Equipment

Radars	1	Decca RM 916C, 48 mile
	2	Furuno, 24 mile

Echo Sounder	Decca Elac LAZ-72
Sonar	Decca Elac Miniloader
Autopilot	Wagner MK IV
Loran C	Raynav 500 C
VHF R/T/ 1 2	Clipper AF 54 Regency MT 55
MF R/T	Daniels DE 1100

Life-saving Equipment

Dinghy (1)	4 person
Liferaft (1)	8 person
Lifebuoy	2
Lifejackets	6, DOT approved
Survival Suits	9
EPIRB	1

Description of Vessel

The West Coast designed fishing vessel was constructed of steel, having a sharply raked bow, a raised foredeck, a stepped aft deck and a transom stern. The aluminum house was sited on the foredeck and contained the control position forward, the chart table aft to port, and a seat aft to starboard. Below the foredeck, at the forward end were two berths to port and starboard. Further aft was a two berth cabin to port and the shower, head and sink to starboard, the machinery space access companionway with the galley aft and the dinette to port. The machinery space was below the accommodation area and the latter opened on to the large aft deck containing the fish-hold hatch coamings; aft of the fish-holds was the lazaret.

Note: 1. All times are expressed in Pacific Daylight Saving Time (UTC minus 7 hours)

2. The term 'capsize' is used in this report for simplicity of terminology, in fact the "SAMWISE" took a heavy 'angle of loll', downflooded and, presumably, foundered.

Background

The fishing vessel "SAMWISE" with a crew of nine departed Ucluelet on the west coast of Vancouver Island at 2200, August 31, 1987 bound for the fishing grounds of La Perouse Bank. The vessel carried 437 black cod traps on deck and 17.66 t (17.4 tons) of bait and ice in her holds. Approximately one hour after departure, the two forward holds were tanked down and the vessel continued her voyage at reduced speed.

By 0330, September 1, the wind had increased slightly and the sea became moderate causing waves to break on the aft deck; shortly after, the "SAMWISE" heeled over to port and did not recover. The list rapidly increased as the crew launched the liferaft and abandoned the sinking vessel: all were later rescued in good health and brought back to Ucluelet.

The "SAMWISE" was not sighted again and she is assumed to have foundered. A typical resale value for vessels of this class is in the order of $750,000.

This is the third Canadian West Coast fishing vessel engaged in the black cod fishery to capsize within the last 18 months; all three capsizings had, as a contributing cause, a heavy load of traps on deck.

There was no reported pollution following this casualty.

Narrative

The "SAMWISE", under the command of her then skipper, made one trip in July to the fishing grounds in the Seamount area and the catch of black cod fish was loaded and frozen on board the vessel for the return leg of the voyage.

After that trip, the vessel remained alongside the dock for four weeks preparing for the black cod opening on September 1. During that time, the majority of the crew, all experienced black cod fishermen, were hired and minor changes were effected to the vessel i.e., solid ballast was laid on the bottom and stabilizer poles were fitted to ready the vessel for departure.

At 2200, August 31, the "SAMWISE", with a crew of nine, departed Ucluelet on the west coast of Vancouver Island for the fishing grounds of La Perouse, a distance of some 30 miles to the south-west. The weather forecast was variable winds and a light to moderate westerly swell.

The vessel carried a full load of fuel and fresh water, 437 black cod traps stowed and lashed down on the main deck aft to an approximate height of 2 m, 4.06 t (4 tons) of ice in the two forward holds and 13.6 t (13.4 tons) of frozen bait stowed in the two aft holds.

One hour after sailing a south-westerly course, in good weather conditions with the wind from the west-north-west at 10 to 15 knots and a low westerly swell, the vessel's speed was reduced to idling while the two forward holds commenced being filled with sea water to mix with the ice, a standard procedure for vessels engaged in fresh black cod fishing where sea water is cooled with the ice to assist the refrigeration system on board. Shortly after departure the stabilizer poles were lowered to an approximate angle of 45° as a routine safety precaution but the stabilizers were not used.

At approximately 2400, the holds were filled and the vessel resumed her course at reduced speed in order to arrive at the fishing grounds for the noon opening. Under the supervision of the skipper, the crew checked the equipment and lashings once more before retiring while the engineer made a last visual check of the engine-room, the tunnel and tightened the manhole cover of the lazaret; everything was reported as being in order. The skipper then made a final inspection of the deck noting that the vessel appeared rather heavy in the water and her freeboard was approximately 30 cm to 45 cm. After observing the vessel for a while and being aware of a good weather forecast, he assigned a crew member to stand watch in the wheel-house for a two hour period and went to his quarters at 0130.

The "SAMWISE" continued on her south-westerly course for the next two hours. Steering was on autopilot, with a crew member in charge of the watch stationed in the wheel-house and the engineer in the galley. At approximately 0300, the wind increased to 25 to 30 knots from the west-north-west with the waves increasing to 2 m and visibility reduced in fog patches to zero at times. The engineer, on looking through the aft door leading on to the deck, noticed that waves were coming over the starboard side of the deck. At first, the water easily cleared the deck but as the waves increased in size, more water was shipped on deck in quantities such that the water was unable to clear the deck before the next wave was shipped. It appeared to the engineer that

the retention of water on deck was due to the tightly packed fish traps keeping the water from running out freely through the freeing ports. Realizing that water was accumulating on the afterdeck, the engineer went to the wheel-house to inform the deck-hand on watch so that he could take corrective action by altering the vessel's course. As the engineer entered the wheel-house, three successive larger waves heeled the "SAMWISE" on her port side to an angle of approximately 30° from which she was unable to recover.

The person in charge of the watch switched over steering from autopilot to manual and altered course to starboard to bring the waves directly ahead, at the same time as the skipper was coming into the wheel-house. The skipper immediately took charge of the vessel and altered the ship's heading further to starboard in the hope of counteracting the angle of heel and ridding the deck of accumulated water.

The manoeuvre proved futile and the skipper issued a 'MAYDAY' distress call on frequency 2182 kHz on the MF R/T. The call was immediately acknowledged by Tofino Coast Guard Radio Station (CGRS) at 0343 and under instructions from RCC, tasked the Fisheries Patrol Vessel "TANU", the Canadian Coast Guard Cutter (CCGC) "RACER", the Bamfield lifeboat and diverted the freighter "NASAC SUN" to the search area.

When the vessel first heeled and remained on her port side, the engineer yelled for everyone to reach for survival suits and as the skipper was transmitting the 'MAYDAY' message the crew rushed to the two staterooms where they were stowed. Two crew members were unable to locate their suits and remained with the skipper in the wheel-house. A crew member who had experienced two previous capsizings went to the liferaft located aft of the wheel-house and attempted to launch it on the port side. He experienced considerable difficulty as he was wearing a survival suit and the liferaft was tangled up in the vessel's rigging. The liferaft was eventually inflated and pushed away from the listing vessel. Four crew members stood at the stern of the vessel while the others were forward. As the list increased, the crew members who were then on the starboard side of the hull jumped in the water after the skipper had advised the Tofino CGRS that the crew was abandoning the vessel. The skipper took the EPIRB from the wheel-house and placed it inside his survival suit before he abandoned his vessel.

All were able to swim to the liferaft: of the 9 crew members, 7 were wearing survival suits and 2 wore life-jackets. The time lapse between the first alarm and the boarding of the liferaft was estimated by the crew at four minutes. The skipper immediately activated the EPIRB as the

liferaft slowly drifted away from the sinking vessel which, by now, was lying on her side with the propeller still engaged to the shaft and slowly turning at idle speed.

The Fisheries Patrol vessel "TANU", en route to the position given by the skipper of the "SAMWISE" in his first 'MAYDAY' message, was able to monitor the distress signal emanating from the EPIRB at 0559 thereby obtaining a DF bearing. She then altered course and at 0624 sighted the liferaft some 50 m away in dense fog. The workboat of "TANU" was lowered and all 9 crew members were rescued and brought aboard; the liferaft was recovered and the EPIRB was silenced. The "TANU" transported the survivors to Ucluelet where all disembarked in good health.

The position of the "SAMWISE" as given to Tofino CGRS by the skipper of the "SAMWISE" in his initial distress message was fixed at Lat. 48°47.1'N, Long. 126°01'W using Loran C co-ordinates and the survivors were picked up some 3 hours later in position Lat. 48°47.8'N, Long. 125°55'W. A Notship was issued in view of the danger of the derelict but as the vessel was not sighted again, she is assumed to have foundered.

There was no reported pollution as a result of this casualty.

Analysis

1. Weather

The Marine forecast for B.C. coastal waters issued by Environment Canada at 1145 Friday, July 31, 1987 read as follows:

> West Coast Vancouver Island
> Winds variable 5 to 15 knots becoming
> north-westerly 10 to 20 this afternoon.
> Isolated afternoon showers.
> Outlook. Moderate to strong north-westerly winds.

The forecast issued at 2345 of the same day read as follows:

> West Coast Vancouver Island
> Winds variable 5 to 15 knots. Local fog
> patches overnight reducing the visibility
> to near zero.
> Outlook. Moderate north-westerly winds.

The Canadian forecast was consistent with the American forecast and were broadcast on the VHF continuous weather channels. Both forecasts, along with the forecast from Prince Rupert on the MF R/T were listened to by the skipper of the "SAMWISE" prior to departure. The forecast proved to be fairly accurate as the wind experienced overnight came from the north-west at 15 to 20 knots for the first part of the voyage but then increased to 25 to 30 knots from the west-north-west during the last hour. Wind and sea conditions were 'moderate', and would not normally have been expected to be a factor in a casualty involving a vessel the size of the "SAMWISE".

2. Inspection

The "SAMWISE", a small fishing vessel whose registered length did not exceed 24.4 m and whose gross tonnage was over 15 tons but not exceeding 150 tons, was required by section 46(1) of the Small Fishing Vessel Inspection Regulations to be inspected once every four years by the Ship Safety Branch of the Canadian Coast Guard; this periodic inspection includes:

- life-saving, fire-extinguishing and navigating equipment;
- engine trial/inspection;
- hull inspection inside and out when dry-docked or beached;
- fire and bilge pumps, rudder, tailshaft and all sea connections; and
- approved electrical installations.

Part of this quadrennial inspection was completed in March 1984, in Richmond, B.C., with the equipment inspection being completed in March 1985. A Ship Inspection Certificate was issued dated March 7, 1985, with expiry date November 29, 1987 to coincide with the mandatory drydocking/slipping of the vessel.

3. Life-saving equipment

The life-saving equipment requirements for small fishing vessels exceeding 12.2 m in length is contained in section 30(4) of the Small Fishing Vessel Inspection Regulations and states in part:

> (4) every fishing vessel exceeding 12.2 m in length shall carry .....
>
> (c) in the case of a vessel the keel of which was laid on or after January 6, 1965,
>
> (i) a boat, dory or skiff capable of accommodating not less than four persons;
>
> (ii) an inflatable liferaft of sufficient capacity to accommodate
>
> A) 50 per cent of the person on board, or
>
> B) if the vessel makes voyages other than inland voyage and goes beyond the limits of Home-trade Class III voyages, 75 per cent of the persons on board, and
>
> (iii) if the equipment required by sub-paragraph (i) and (ii) is not capable of accommodating 1 1/2 times the number of persons on board, such additional boats, dories, skiffs or inflatable liferafts as are necessary to provide accommodation in the aggregate for 1 1/2 times the number of persons on board.

As the vessel's complement was 9 persons, she would have been required to have a combined boat/liferaft capacity for 14 persons but, the "SAMWISE" carried one approved rubber boat for 4 persons and an 8-person inflatable liferaft for a total capacity of 12 persons and thus did not meet the requirements of subsection (iii) above.

The inflatable liferaft was last inspected on March 11, 1985 and its yearly inspection, due on March 11, 1986, was not carried out as required by Schedule XI, section 1 (3) of the Life Saving Equipment Regulations which state in part:

> (3) Inflatable liferafts shall be tested annually .... by an approved person...

The Small Fishing Vessel Inspection Regulations require that every fishing vessel carries one approved life-jacket for each person on board and although the Ship Inspection Certificate showed that 6 approved life-

jackets were on board the vessel at the time of inspection, it was reported that additional approved lifejackets were placed on board for the full complement of 9 crew members. Although not required by Regulations, 9 survival suits were reportedly placed on board the vessel before sailing but when she was being abandoned 7 survival suits and 2 lifejackets were used; the others could not be found and are assumed to have been left on board the vessel.

4. Other west coast black cod fishery vessel losses

Concerned about the safety of vessels involved in the black cod fishery, the Ship Safety Branch of the Canadian Coast Guard sent a letter dated November 5, 1985 to several companies participating in the fishery. The letter drew their attention to the possibility of their vessels operating in an unsafe departure condition because of an unrestricted above-deck complement of gear and cod traps. The companies were urged to contact the Ship Safety Branch office confirming that the loading conditions were within the capabilities of the vessel.

A similar letter repeating their concern was once again sent to vessel owners participating in the black cod fishery by the Ship Safety Branch on July 18, 1986. The owner of the "SAMWISE" did not receive either letter as he was not operating his vessel in the black cod fishery at the time.

On March 17, 1986, after filling her fish tanks with water and with some 480 traps with their associated gear on deck, in moderate weather conditions, the 85 gross-ton "PACIFIC LEADER", rolled over and subsequently sank at the entrance to Juan de Fuca Strait. Two out of the crew of seven lost their lives.

On May 12, 1986, after filling her fish tanks with water and with some 275 traps with their associated gear on deck, in moderate weather conditions, the 64 gross-ton "VIKING LEADER", rolled over off the entrance to Barkley Sound. The vessel was subsequently salvaged.

The Marine Casualty Investigations Division of Transport Canada conducts inquiries into 'shipping casualties/accidents' and the resultant Reports of these Investigation produced are distributed, free of charge, to the industry and the public upon request. Reports of Investigation into the loss of the "PACIFIC LEADER" and the "VIKING LEADER" had been published; however, the skipper of the "SAMWISE" was not aware of these publica-

tions nor was he aware of the circumstances of these casualties.

5. Certificates and licences

As the "SAMWISE" was a fishing vessel not exceeding 100 gross tons, her skipper did not hold any marine Certificate of Competency nor was he required to by the Canada Shipping Act.

The "SAMWISE", being propelled by a diesel engine of less than 10 nominal horsepower, was not required by the Canada Shipping Act to carry a duly certificated engineer and her engineer held no such Certificate of Competency.

The General Radio Regulations made pursuant to the Radio Act and the Ship Station Technical Regulations made pursuant to the Canada Shipping Act both require that radiotelephone equipment installed on board any vessel shall only be operated by persons holding an appropriate Certificate of Proficiency in Radio Operations. In most instances a Restricted Radiotelephone Operator's Certificate (Maritime) will suffice. The skipper of the "SAMWISE" did not hold such a certificate or any other radio certificate. Proper procedure was used by the skipper to transmit the 'MAYDAY' message. The transmission was clear and was acknowledged by the CGRS.

The radio station on board the "SAMWISE" was licensed by the Minister of Communications in accordance with the General Radio Regulations.

As required by the Ship Station Radio Regulations made pursuant to the Canada Shipping Act, the "SAMWISE" was equipped with a VHF R/T and, voluntarily, with a MF R/T.

These installations were required to be inspected annually under the Ship Station Technical Regulations which state in part:

> 70(4) A Radio Inspection Certificate .... shall be valid for a period not exceeding one year from the date of issue.....

The "SAMWISE" was issued a Radio Inspection Certificate on March 4, 1985 valid until March 3 1986. As this Radio Inspection Certificate had expired some 17 months prior to the casualty and had not been renewed since, the "SAMWISE" did not meet the requirements of the Ship Station Technical Regulations.

6. Vessel history

The "SAMWISE" was originally built for service as a long-liner and herring packer and shortly after completion, an inclining experiment was carried out October 2, 1979; the resulting Trim and Stability Booklet was subsequently approved by the Canadian Coast Guard Ship Safety Branch on February 22, 1980.

The approved Trim and Stability Booklet incorporated seven longlining and two herring packing operating conditions, all of which showed the vessel trimmed by the bow. The calculated trims for the departure and fully loaded arrival conditions while longlining and herring packing, varied from 1.0 m (38.5") to 0.7 m (28") by the bow. The vessel had a designed rake of keel of 0.61 m (24") and prior to entering the black cod trap fishery, trimming ballast was installed in the lazaret and the after end of the shaft tunnel in order to reduce the apparent trim and improve the vessel's handling and steering characteristics. No precise written record of the trimming ballast was kept nor was the Ship Safety Branch informed of its installation in the vessel. The ballast was comprised of approximately 5 t (4.9 tons) of boom chains and bagged steel punchings and reportedly while on a fishing trip shortly before the casualty, a quantity of boom chains was removed and utilized as sinker weights. Consequently, the actual weight of trimming ballast and securing boards remaining on board the vessel was estimated by the skipper to have been in the order of 4 t (9,000 lb).

Examination of original drawings and later photographs, together with discussions with the designers, builders, current owner and skipper, indicates that modifications were also carried out to the vessel's original as-built outfit and the known changes are summarized as follows:

Items removed from the vessel

i)	Two alloy booms 11.60 m (38'-0") (8"dia)	523 kg	(1,150 lb)
ii)	One 'A' alloy boom 6.70 m (22'-0") (8"dia)	386 kg	(850 lb)

Items added to the vessel

(i)	Two steel booms 9.10 m (30'-0") (6"dia)	550 kg	(1,210 lb)

(ii)	Two steel stabilizer booms 8.50 m (28'-0") (4"dia)	307 kg	(675 lb)
(iii)	Two stabilizers & mast outrigger	234 kg	(515 lb)
(iv)	3"dia. steel rails at stern bulwark P & S	325 kg	(715 lb)
(v)	Fishing Table at Transom	51 kg	(112 lb)
(vi)	Penboards aft of power drum	255 kg	(560 lb)
(vii)	Trimming ballast in lazaret	4090 kg	(9000 lb)

The cumulative effects of the modifications may be noted by comparison of the vessel's as-built and current lightship characteristics with all hydraulic, lubrication, refrigeration, cooling and fuel systems primed to operating levels and no fishing equipment on board.

Item	Weight	V.C.G. (Above B/L)	L.C.G. (Fwd of midships)
As-built Lightship	137.77 Tonnes 135.56 Tons	3.625 m 11.89 ft	1.50 m 4.94 ft
Current Lightship	143.07 Tonnes 140.47 Tons	3.600 m 11.81 ft	1.22 m 4.01 ft

7. Vessel loading prior to casualty

The following details and weights of consumables, stores, bait, fishing gear and cod traps onboard the "SAMWISE" upon departure are the 'reported best estimate' based upon post-casualty discussions with the owner and skipper:

Item	Weight Tonnes (Tons)	Location
Fuel Oil	11.60 (11.42)	Aft Peak (P&S) 98%
Fuel Oil	7.21 (7.10)	Aft Tanks(P&S) 78%
Fuel Oil	5.72 (5.63)	Engine-room (P&S)
Fresh Water	5.16 (5.08)	F.W.Tank (P&S) 95%
Ice (preservation)	4.06 (4.00)	Fwd Holds (P&S)

Bait (Frozen) (Squid & Hake)	13.61	(13.39)	Aft Holds (15,000 lb ea)
Cod Traps 320 (48"dia)	8.41	(8.28)	Main Deck
Cod Traps 117 (58"dia)	3.72	(3.66)	Main Deck
Rope,'Korean' 7,500 fathoms, (7/8" dia)	3.06	(3.01)	Power Drum
Rope,'Danline' 7,500 fathoms, (3/4" dia)	2.17	(2.14)	Power Drum
Rope,'Danline' 500 fathoms, (3/4"dia)	0.14	(0.14)	Forecastle Deck
Flag poles & sinkers (17)	0.18	(0.18)	Main Deck
Buoys, 26 (20"dia)	0.12	(0.12)	Main Deck
Buoys, 16 (20"dia)	0.07	(0.07)	Forecastle Deck
Fishing gear Miscellaneous	0.20	(0.20)	Main Deck
Fishing gear Miscellaneous	0.10	(0.10)	Forecastle Deck
Crew's effects & stores	0.92	(0.90)	Accommodation
Ship's stores	1.02	(1.00)	Main Deck

Details of the vessel's general arrangement, location of the deck load of fishing gear and holds and tanks contents, together with the related minimum freeboard, are illustrated in Figure No.1.

Approximately one hour after departure, seawater was reportedly pumped into the forward fish-holds until the level of the previously loaded preservation ice and seawater reached into the hatch coamings to just above main deck level. The vessel's deadweight and total displacement

then exceeded those of the heaviest herring packing operating condition included in the approved Trim and Stability Booklet and consequently, the amidships freeboard and transverse stability were effectively reduced.

Reportedly on previous fishing trips the number of black cod traps loaded on deck had not exceeded 300 and the forward fish-holds had not been filled with iced seawater because the hold refrigeration system had been utilized for the preservation of the stowed catch. Because of the lighter above-deck loading and lower total deadweights, the previous black cod loading conditions resulted in significantly higher freeboards and ensured greater ranges of positive stability than those existing at the time of the casualty.

8. Freeing Ports and Free-surface

Six freeing ports, each measuring 1.10 m x 0.15 m (3'6" x 6"), were incorporated in the 0.84 m (2'9") high bulwarks on the port and starboard sides of the main deck providing an area of approximately 0.97 mm^2 (10.5 ft^2) on each side of the vessel. The freeing ports were arranged at main deck level and extended from 0.90 m (3'0") forward of amidships to within 3.96 m (13'0") of the transom; no freeing ports were fitted in the bulwark across the transom.

When the forward holds were filled up with 55.75 t (54.86 tons) of preservation ice and seawater, the minimum freeboard was reduced to 0.35 m (1'2") and even moderate rolling of only 5.75° in flat calm seas would cause water to be shipped on deck. In the prevailing sea conditions, the effectiveness of the freeing ports in the port and starboard bulwarks was impaired as the deck edge became immersed at the end of each roll and the shipped water was not always completely cleared. Shortly before the casualty, the water had accumulated toward the after end of the main deck.

The water was initially shipped at the end of each roll near amidships and the vessel's forward speed and motion caused it to flow aft and become entrapped across the full width of the intact transom bulwark. The weight and location of the accumulating water progressively increased the trim aft, reduced the effective freeboard and accelerated the rate at which the water was being shipped.

Initially the quantity of shipped and entrapped water was not great, consequently, the free surface effect of a nominal layer only 76 mm (3") deep, extending across the

main deck in the area aft of the freeing ports, was included in the post-casualty stability calculations and is considered to be a conservative representation of the actual deck flooding condition (see Fig. No.1). When re-creating the vessel's stability characteristics at the time of the casualty, due allowance was also made for the free surface effect of the loose liquids in the partially-filled fuel oil and fresh water tanks; no such allowance was made for the seawater and ice reportedly 'pressed up' into the forward holds hatch coamings. It is possible that the melting and breakdown of the preservation ice floating on top of the seawater in the forward hatch coamings lowered the total level and caused the free surface to increase as it extended over the complete areas of both forward holds. Consequently because of the above factors, it is considered that the vessel's actual transverse stability characteristics in the prevailing sea conditions were in fact, worse than those indicated by the post-casualty idealized calculations.

In general, few fishermen fully understand free surface effect and fewer appreciate the substantial loss of transverse stability when water, even a few inches, is shipped and retained on deck. Coupled with the sudden reduction of effective waterplane area when the deck edge is submerged, the effect can be disastrous.

Furthermore, some critical wave heights, lengths and frequencies, in conjunction with a particular vessel's length, hull form, motion, attitude and speed can cause a dramatic loss of waterplane area and hence stability. If the "SAMWISE" encountered such a situation then the impetus caused by such a sudden reduction or fluctuation could have overcome her already low dynamic stability characteristics and initiated the heeling from which she did not recover.

In summary, because of the increased weight of cod traps on deck, the weight of the fishing warps on the power drum, the reduced freeboard, the free surface effect of the water shipped on deck and possible encounter with a critical wave formation, the "SAMWISE" did not have sufficient transverse stability to withstand the dynamic heeling effects imposed on her in the prevailing conditions.

9. Casualty Stability

As a small fishing vessel of more than 15 gross tons, not engaged in fishing for herring or capelin, the "SAMWISE" was not required to comply with the intact stability requirements of Part 1, Section 29, of the Small Fishing

Vessel Inspection Regulations. Regulatory approval is based upon compliance with criteria detailed in the Canadian Coast Guard 'Stability, Sub-division and Load Line Standards', STAB 4. Although the "SAMWISE" was not required to comply with these requirements, they are considered to be the most appropriate yardstick against which the stability characteristics of fishing vessels of this size may be assessed, notwithstanding the mode of fishing in which they may be employed (the actual minimum criteria of STAB 4 are listed in Annex 1 of this report in order that a perspective of the vessel's actual transverse stability characteristics may be made by direct comparison with the calculated figures).

A post-casualty analysis of the transverse stability characteristics of the "SAMWISE" was carried out incorporating the current estimated lightship data, together with the reported weights and vertical locations of the black cod fishing gear, traps and warps, etc. The calculations showed the reduction of the effective freeboard when the fish-holds were topped-up with seawater after departure and the analysis focused on the detrimental effects of the water subsequently shipped and reportedly retained on deck shortly before the casualty.

It should be noted that the calculated transverse stability characteristics are based upon the 'ideal' static sea state. In actual dynamic sea conditions, angles of roll are usually greater than calculated by static methods and because of the uneven effects of wave motion and ship speed, the calculated reserve dynamic stability of small vessels is subject to considerable fluctuation.

The reported consumables and fishing gear loading details show that on departure, the vessel's transverse stability characteristics complied substantially with the minimum requirements of STAB 4. The minimum dynamic and statical stability requirements were just met, however, the maximum righting lever which was reached at 25°, was only 87% of the minimum requirement. The minimum freeboard of 0.78 m (2'7") was located approximately 2.54 m (8'4") aft of amidships and ensured that the deck edge would not be immersed until the angle of heel reached 12.5°.

After departure, when the vessel's forward fish-holds were filled with seawater, the mean draught was increased by 0.43 m (1'5") and the minimum freeboard was reduced to 0.35 m (1'2"), the vessel's transverse stability characteristics were also significantly reduced such, that the dynamic stability up to 40°, and the maximum righting lever which was reached at just 20°, were only 79% and 61%

respectively, of the minimum requirements. In this loading condition, moderate rolling of only 5.75° would cause the main deck edge to become immersed and lead to the shipping and accumulation of water on deck.

Reportedly, shortly before the casualty, shipped water was seen to have accumulated toward the aft end and at the sides of the main deck; the weight and free surface effects of which caused a drastic deterioration of the vessel's already lowered stability characteristics. In this loading condition, the maximum righting lever (GZ) of 0.058 m (0.19 ft) was reached at 11°, the total dynamic stability (area under the GZ curve) was 0.015 mR (2.80 ft°) and the range of positive stability was only 24°.

These maximum figures are markedly below the minimum standards of STAB 4 in that the total dynamic stability reached at 24° is only 16.5% of the minimum requirement for angles up to 40°. Furthermore, the maximum righting lever attained at just 11° was only 28% of the minimum requirement which should be achieved at not less than 25° heel.

The calculated stability characteristics given above are based upon the 'ideal' static sea state and take into account a conservative assessment of the quantity of water reportedly shipped and retained on deck. Consequently, it is considered highly likely that the actual stability of the "SAMWISE" was less than that indicated by the post-casualty calculations.

It would appear that while the "SAMWISE" was in the highly vulnerable state indicated by the above characteristics, the dynamic heeling effects produced by the impetus of her rolling in the prevailing sea conditions, overcame the vessel's initial ability to recover. Having immersed the main deck edge and been rolled toward the limiting range of positive stability, the vessel, because of the increasing weight of water shipped on one side in conjunction with the reduction in righting levers, tended to remain heeled to port for some time. As water continued to be shipped through the freeing ports the angle of heel increased until, at approximately 18.5°, the bulwark top rail was immersed. The sudden acceleration in the rate and quantity of water being shipped and retained on the port side increased the angle of heel, retarded and eventually prevented the vessel's recovery.

After the vessel was abandoned, downflooding into the accommodation and other compartments by way of unsecured weathertight doors, etc. continued until the vessel lost

all reserve buoyancy and, it is assumed, foundered.

Because of the foggy weather conditions, the time and location of the actual sinking is unknown and it is uncertain whether or not the vessel actually completed her capsize before the downflooding caused her to founder and sink.

10. Possibility of Water Ingress

A full width binnacle shelf across the fore end of the wheel-house featured the navigational equipment, the engine controls and alarm panels which included the engine-room and lazaret bilges high water alarms. These alarms were reported to have been in good working order and, as they did not come into operation it is concluded that no unusual amount of water found its way into these spaces prior to the capsizing. The engine-room was inspected shortly after tanking down and found to have been dry.

11. Experience of Crew

The skipper commenced sailing on the west coast of British Columbia in 1973 as a deck-hand on trollers, fishing for herring and salmon. In 1978 he bought his own troller, sailing the West Coast from Cape Flattery to Dixon Entrance until 1984. In 1985 and 1986, he chartered a fishing troller during each season and in July, 1987 was hired to operate the "SAMWISE". The "SAMWISE" was his first experience on a black cod trap fishing vessel and prior to this last voyage, had made one successful fishing trip to the Seamount fishing grounds.

With the exception of one crew member, the crew had extensive black cod trap fishing experience but were on their first trip on the "SAMWISE" except for one crew member who had made one fishing trip two years earlier.

The person who had the conduct of the vessel at the time of the casualty had sailed since 1980 mostly on black cod trap fishing vessels and was conversant with the method of ballasting and fishing.

The engineer had 25 years experience at sea and had sailed four seasons on a black cod fishing boat which had used the freezing system; this was his first trip on the "SAMWISE".

Findings

On September 1, 1987, while enroute to La Perouse fishing grounds in moderate weather conditions, the "SAMWISE" capsized as a result of having insufficient transverse stability to withstand the dynamic heeling forces imposed upon her. She is presumed to have subsequently down-flooded and foundered.

It would appear that the following factors contributed to the loss of transverse stability leading to the vessel's capsize:

- at the time of departure, the vessel was heavily laden with traps and gear on deck which raised the vessel's centre of gravity;

- the total deadweight was increased and the freeboard and transverse stability reduced when the forward fish-holds were pumped full of seawater;

- the reduced freeboard allowed water to be shipped on deck at relatively small angles of heel;

- the free surface effect and weight of water shipped and retained on deck severely reduced the vessel's transverse stability, and

- the reduced transverse stability retarded the vessel's rate of recovery from an initially moderate roll to port allowing time for downflooding to commence and continue until the reserve stability was overcome and the vessel, heavily listed over to her beam-ends, finally foundered.

Other Findings

The use of the EPIRB saved considerable search time in locating the survivors in the liferaft.

Two crew members were unable to find their survival suits because of the location of the suits and the speed with which the vessel laid-over.

Being the vessel's first known voyage employing the 'champagne' (chilled seawater) method of carrying black cod, simultaneously with a deck load of traps, the crew did not fully appreciate the consequences of its effect on the stability of the vessel.

The capacity of the boat/liferaft carried aboard the "SAMWISE" did not meet the requirements of the Small

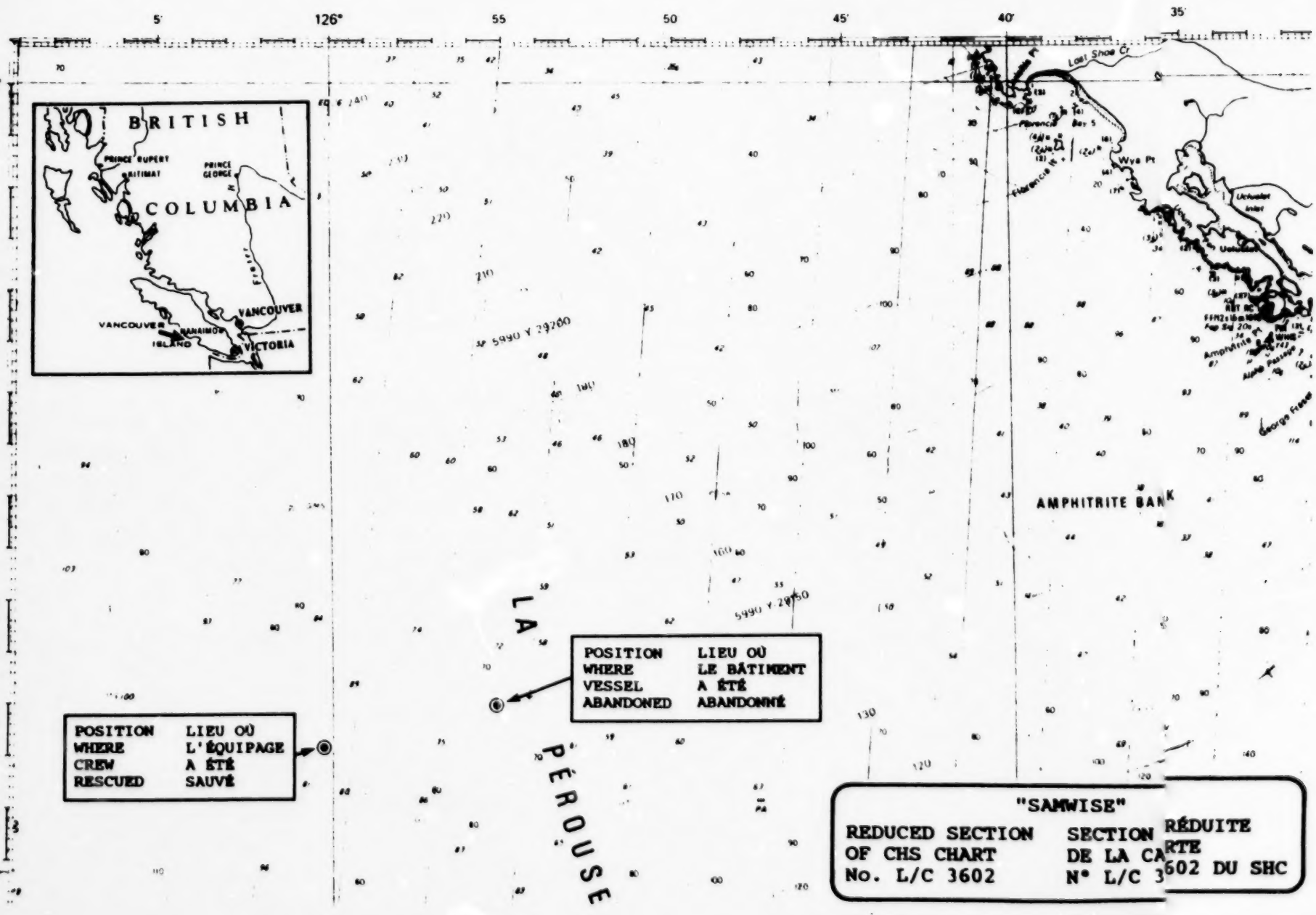
Fishing Vessel Inspection Regulations.

The liferaft aboard the "SAMWISE" was not inspected annually as required by the Life Saving Equipment Regulations.

None of the crew aboard the "SAMWISE" held a Restricted Radiotelephone Operator's Certificate (Maritime) as required by the Ship Station Technical Regulations and General Radio Regulations.

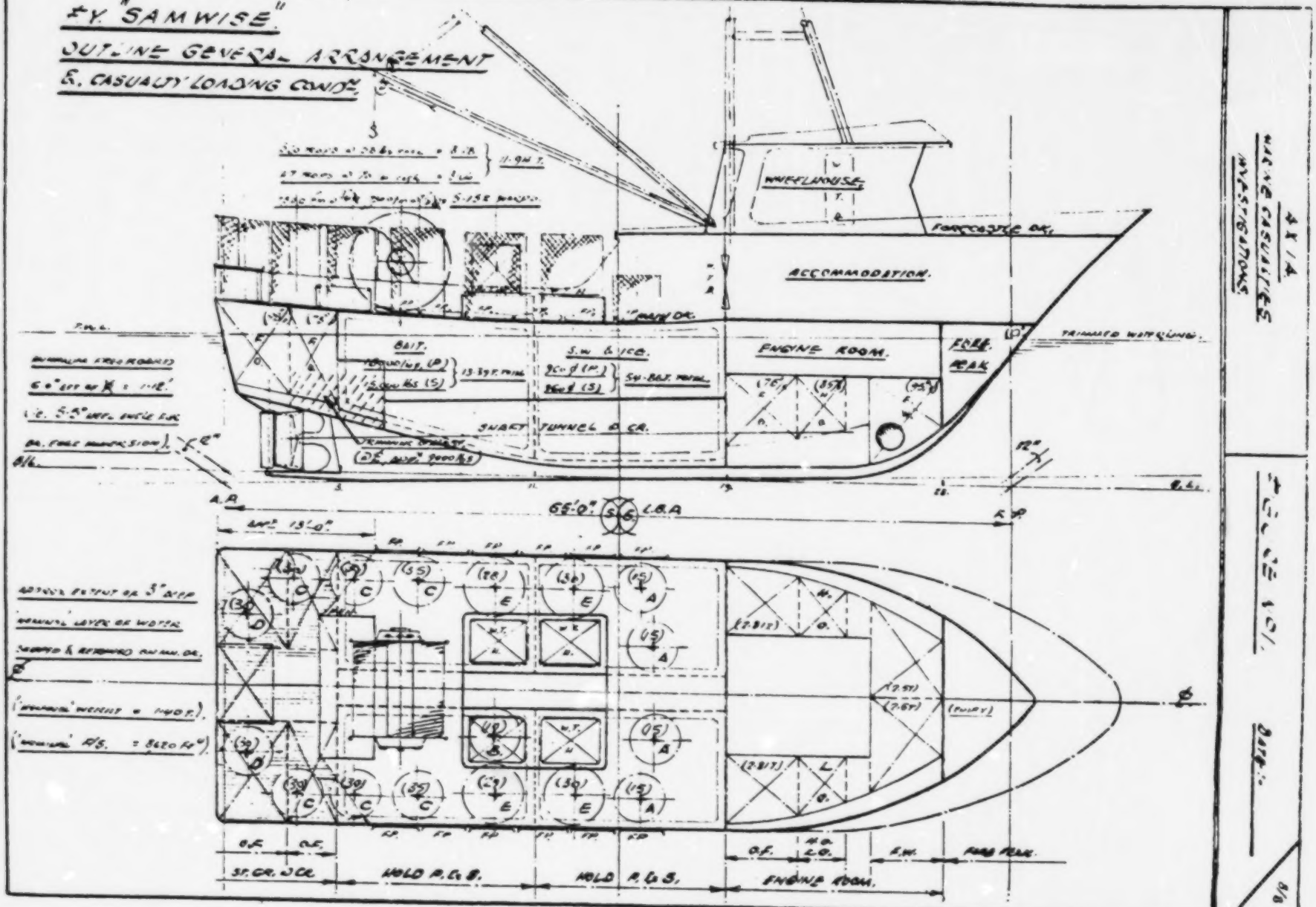
The radio station aboard the "SAMWISE" was not inspected annually as required by the Ship Station Technical Regulations.

OTTAWA, ONTARIO
APRIL 1988.


5'
126°
55
50
45'
40'
35'
BRITISH
COLUMBIA
PRINCE RUPERT
PRINCE GEORGE
VANCOUVER
VANCOUVER ISLAND
NANAIMO
VICTORIA
Lost Shoe Cr
Wye Pt
AMPHITRITE BANK
LA PÉROUSE
5990 Y 29200
5990 Y 29150
POSITION WHERE VESSEL ABANDONED
LIEU OÙ LE BÂTIMENT A ÉTÉ ABANDONNÉ
POSITION WHERE CREW RESCUED
LIEU OÙ L'ÉQUIPAGE A ÉTÉ SAUVÉ
"SAMWISE"
REDUCED SECTION OF CHS CHART No. L/C 3602
SECTION RÉDUITE DE LA CARTE N° L/C 3602 DU SHC

F.Y. "SAMWISE"

OUTLINE GENERAL ARRANGEMENT & CASUALTY LOADING CONDN.



F.Y. "SAMWISE"
MAIN CASUALTIES
MYSTERY POINTS

Date:

AXIA
MARINE CASUALTIES
INVESTIGATIONS.

CONDITION N° _____ DATE:- _____

S.E.V. 'SAMWISE'

DERIVATION OF CURRENT LIGHTSHIP WT, VCG & LCG, AS AT 1987.

ITEM.	WT. (TONS)	VCG. (FT)	V. MT. (FT T.)	LCG (FT ⁻ ⁺)	L. MT. MOMENT (+)	L. MT. MOMENT (-)	F.S. (FT)
LIGHTSHIP (AS BUILT).	(+) 38.56	11.39	1611.87	41.94 +	669.67		-
ITEMS REMOVED:-							
2 @ 38'-0" HOLD BOOMS (" 1150 lb)	0.54	35.00	17.85	5.30 -		2.80	-
1 @ 28'-0" 'A' BOOM. (8"ϕ x 80) 1500 lb	0.38	33.00	12.54	1.00 -		0.38	-
	(-) 0.89		(-) 30.39		3.18	3.18	-
ITEMS "ADDED":-							
2 @ 1100 lb STAYSAILS & RIGGING	0.14	72.00	3.08	5.50 +	0.77		
2 @ 30'-0" STEEL BOOMS (6"ϕ 80)	0.54	32.50	17.55	2.5 -		1.35	
2 @ 28'-0" STAYSAIL BOOMS. (4"ϕ)	0.30	35.00	10.50	5.50 +	1.65		
1 @ 26'-0" STABILISER "OUTRIGGER"	0.09	48.00	4.32	5.50 +	0.49		
STEAM PIPES 3½" STEEL.	0.32	19.50	6.26	31.0 -		9.92	
STEAM PIPE AT TRANSOM.	0.05	17.00	0.85	31.0 -		1.55	
PER BOOMS I.W.O. EQUAL.	0.85	44.50	3.62	22.0 -		5.50	
" " " I.W.O. ST. GEAR	0.09	9.00	0.81	27.0 -		2.43	
RUNNING BALLAST IN HOLDS AT (90.0)	4.02	7.50	30.15	7.5 -		30.15	
	(+) 5.80		+ 77.14		2.91	111.20	
SUMMATION:-	140.47	11.81	1658.56	41.81 (F)	672.95	111.20	
					563.75 (F)		

AXIA.
MARINE CASUALTIES
INVESTIGATIONS.

CONDITION N° 1. DATE 1st

S.E.V. 'SAMWISE'

ANOT DERACTURE CONDITION, WITH 41.0 TONS (MEAN) ICE IN FWD HOLDS.

ITEM.	WT. (TONS)	VCG. (M)	V. MT. (MT)	LCG (M) ±	L. MT. HOGGING (+)	L. MT. SAG. (−)	F.S. (M)
LIGHTSHIP (1987).	1140.47	11.84	1668.86	4.47 F	383.75		-
D.B. (P.S) STOWAGE - No 1. (38%)	11.42	1.90	135.90	29.28 A		334.17	52.0
D.B. (P.S) No 1 - No 3. (73%)	3.10	3.80	69.58	24.90 A		176.79	340
D.B. (P.S) No 13 - No 33 (79%)	5.63	5.70	32.09	17.00 F	67.56		140
H.O. } INCLUDING "LIGHTSHIP" M&W.	-	-	-	-	-	-	
L.O. } T.S.B. & DESANDERS.	-	-	-	-	-	-	
D.W. No 35 - No 28 (P.S) (95%)	5.08	7.40	37.59	23.70 F	120.45		170
FIR TUBES.	0.10	7.00	0.70	6.00 F	1.50		-
FRIDGE TUBES.	0.10	1.50	0.15	6.00 A		0.60	-
CREW & EFFECTS	0.90	17.00	15.30	21.00 F	18.90		-
STORES	1.00	16.00	16.00	14.00 F	14.00		-
MISC ENGINE STORE (MIN OIL) (LAGGING ETC.)	0.80	14.60	11.90	13.0 A		10.40	-
" " " (ENGINE OIL)	0.10	32.30	3.23	5.00 F	0.50		-
FOREPEAK BALLAST (P&S) (ICE)	4.00	6.20	24.80	1.10 F	4.40		-
AFT HOLDS (P & S) AMT — 19000 lbs ea	13.39	8.50	113.81	14.0 A		187.46	-
48" ϕ TUBES (Cu) AT 'A' } EACH 358 lbs	1.58	15.25	23.67	2.0 F	3.16		-
" " (Cu) AT 'B' } TOTAL	0.26	17.35	4.51	11.0 A		2.86	-
" " (Cu) AT 'C' } (320)	0.92	12.83	11.81	27.0 A		24.84	-
" " (Cu) AT 'D'	1.55	17.67	27.39	24.0 A		37.20	-
38" ϕ TUBES (W) AT E & F 704 ea	8.66	12.65	60.94	7.0 A		60.62	-
7500 ft. ½" ϕ "RUNNING" WIRE/100'	2.14	18.10	38.73	18.0 A		38.52	-
7500 ft. ½" ϕ "TOWING" WIRE/100'	3.01	17.10	51.47	18.0 A		54.18	-
SPARE ½" ϕ "RUNNING" SPARE (AFT SIDE)	0.14	20.25	2.84	30.0 F	4.20		-
17 MOORING WIRES & LINES	0.08	14.75	1.18	30.0 A		2.40	-
17 " " HAWSERS (18 EACH)	0.10	14.75	1.47	30.0 A		3.00	-
30 20" ϕ ROPES (2 IN EACH)	0.12	15.00	1.80	30.0 A		3.60	-
18 20" ϕ BUOYS (2 IN EACH)	0.07	22.50	1.57	30.0 F	2.10		-
SUMMATION :—	207.09	11.59	2401.09	1.11 (A)	762.26	993.57	1140 / 1209.35
					230.23 (A)		-0.06

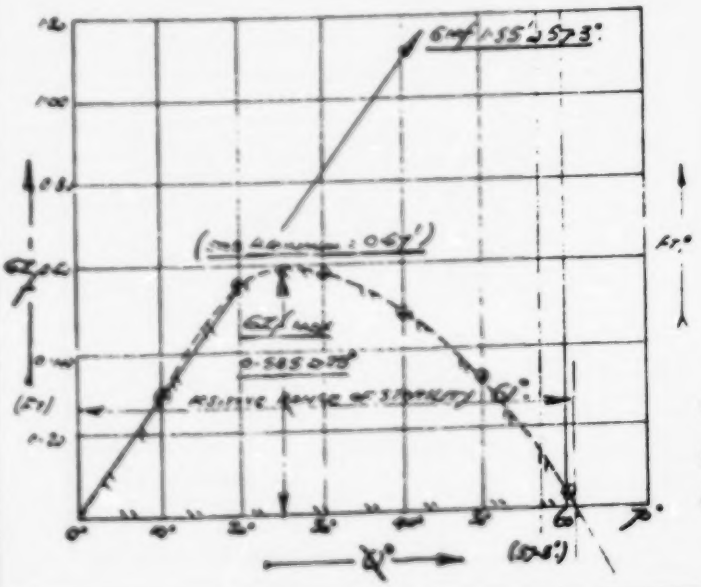
4 X / A MARINE CASUALTY. INVESTIGATIONS.	CONDITION No:- 1. DATE.

S.E.V. "SAMWISE"

NEW DRAFTS 20'.00 & 35	= 0.35	LCB	= 1.20 A
KM T	= 13.30	LCG	= 1.11 A
KG a	= 11.59	'G' to 'B'	= 0.09 F
GM a	= 1.71	TRIM :- $\frac{20.09 \times 0.09}{13.20 \times 12}$	= 0.11 F
F.S. CORRECTION	= −0.16	LCF	= 3.20 A
∴ GM f	= 1.55	DRAFT AFT = $0.35 - \left(\frac{29.2}{65} \times 1\right)$	= 10.30
KG f	= 11.75	DRAFT FORD = $0.35 + \left(\frac{35.70}{65} \times 1\right)$	= 10.41
M.C.T. 1 INCH	= 13.20 F.T.	ASSUMED 'X' CURVES OF B/L	= Zero.

$GZ_f = KN - KG_f \sin \phi^\circ$.

HEEL TO HEEL ϕ°	0°	10°	20°	30°	40°	50°	60°	-
KN	-	2.3370	4.9750	6.9520	8.0410	9.3215	10.2065	-
Sin ϕ°	0	0.1736	0.3420	0.5000	0.6428	0.7660	0.8660	-
$KG_f \sin \phi^\circ$	(-) 0	(-) 2.0135	(-) 4.0185	(-) 5.7975	(-) 7.5529	(-) 9.0045	(-) 10.1755	-
GZ_f	0	0.292	0.9565	1.1545	0.4881	0.3210	0.0310	-



ϕ°	GZ_f	S/n	f.	S/n	f.
0°	0	1	0	1	0
10°	0.292	3	0.876	4	1.168
20°	0.565	3	1.695	2	1.130
30°	0.770	1	0.770	4	3.080
40°	0.481			1	0.481
			3.1501		5.0959

(5.093 4)

Area up to 30°: $\frac{3}{8} \times 10 \times 3.1501$ = 11.813 F.T. (11.341)

Area up to 40°: $\frac{3}{8} \times 10 \times 5.0959$ = 16.979 F.T. (16.91)

Area 30°-40° = 16.979 − 11.813 = 5.166 F.T. (5.64)

AXIA
MARINE CASUALTIES
INVESTIGATIONS

CONDITION N° —

DATE: —

4/18

S.E.V. 'JAMWISE'

LOAD OF CONDITION PRIOR TO CASUALTY, WITH FORWARD HOLDS FILLED. (DRY DOCK).

ITEM.	WT. (TONS)	VCG. (FT)	V. MT. (FT³)	LCG (FT) ±	L. MT. ADVANCED (+)	L. MT. APT. (−)	F.S. (FT)
LIGHTSHIP (1987).	140·47	11·21	1668·56	4·01 ↑	563·75		-
D.F. (P&S) STBD — No 1. (98%)	11·42	11·90	135·90	29·70 —		339·17	530
D.B (P&S) No — No 3. (78%)	7·10	9·30	69·58	34·90 —		176·79	340
D.B. (P&S) No 19 - No 23 (76%)	5·63	5·70	32·09	17·00 ↑	67·56		100
N.O. } MACHINERY "LIGHTSHIP" N.S.W.	-	-	-	-	-	-	
L.O. } F.S.B. & DESIGNERS.	-	-	-	-	-	-	
F.W. No 35 - No 28 (P&S) (95%)	5·08	7·40	37·59	23·75 ↑	120·65		170
SIR SLICES.	0·10	7·00	0·70	8·00 ↑	1·50		-
TUNNEL SLICES.	0·10	1·50	0·15	6·00 —		0·60	-
CREW & OFFICERS	0·90	17·00	15·30	21·00 ↑	18·90		-
STORES	1·00	16·00	16·00	14·00 ↑	14·00		-
MISC FISHING GEAR (NO OIL) (LOST CG)	0·20	14·60	2·90	13·0 —		2·60	-
" " " (FISHING OIL)	0·10	22·50	2·25	5·00 ↑	0·50		-
FORWARD HOLDS (P&S) SW ↑ (ICE)	54·86	3·20	449·85	1·10 ↑	60·34		-
AFT HOLDS (P&S) BOOT — 15000 lbs ea	13·39	8·50	113·81	14·0 —		187·46	-
28" ⌀ TRAWLS (GW) AT 'A' } EACH @ 58 lbs	1·55	15·25	23·64	2·0 ↑	3·10		-
" " (P) AT 'B' } TOTAL	0·26	17·35	4·51	11·0 —		2·86	-
" " (134) AT 'C' } (320)	0·92	12·83	11·80	22·0 —		19·24	-
" " (64) AT 'D'	1·55	17·67	27·39	3·0 —		4·65	-
38" ⌀ TRAWLS (117) AT E @ 70 lbs ea	8·66	12·65	60·94	7·00 —		25·62	-
7500 fm 7/8" ⌀ "MANILLA" @ 10·67 lbs/100'	2·14	18·10	32·74	18·00 —		38·52	-
7500 fm 7/8" ⌀ "NYLON" @ 15·0 lbs/100'	3·01	18·10	54·48	18·00 —		54·18	-
SOUTH 3/4" ⌀ "MANILLA" SPARE (FISHING)	0·14	21·25	3·04	30·0 ↑	4·20		-
17 MANILLA SPARES & LINES	0·08	14·75	1·18	30·0 —		2·40	-
17 " " LINES (138 each)	0·10	14·75	1·47	30·0 —		3·00	-
24 @ 20 lb WARPS (@ 10 lb each)	0·12	15·00	1·80	30·0 —		3·60	-
18 @ 20 lb WARPS @ 10 lb each).	007	22·50	1·57	30·0 ↑	2·40		-
SUMMATION :—	257·95	10·97	2829·74	0·67 (A)	818·80	993·09	1140 / 257·95
					174·29 (−)		−0·13

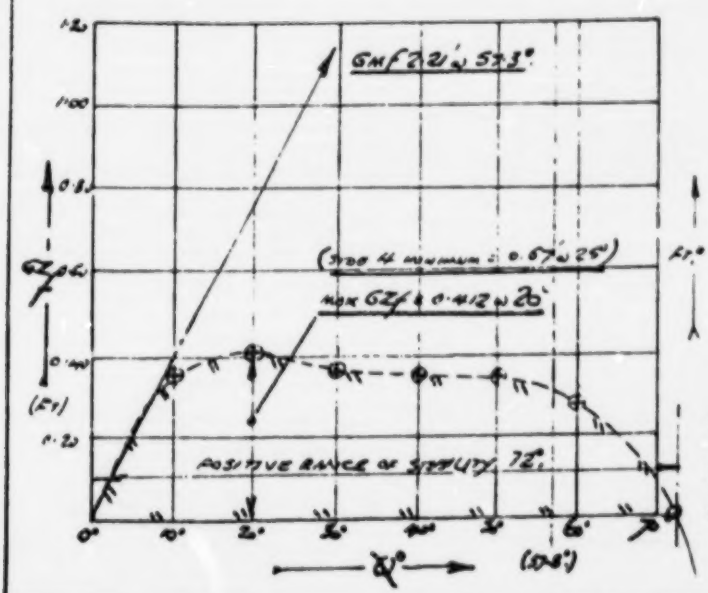
1 & 1 A MARINE CASUALTY. INVESTIGATIONS.	CONDITION No:- 2. DATE.

S.F.V. "SAMWISE"

MEMORANDUM 257.95 Δ SW.	= 11.75	LCB	= 1.564
KMT	= 13.31	LCG	= 0.674.
KG 1	= 10.97	'G' TO 'B'	= 0.89' F
GMS	= 2.34	TRIM :- $\frac{257.95 \times 0.89}{14.74 \times 12}$	= 1.34 F.
F.S. CORRECTION	= −0.13	LCF	= 2.824
∴ GMf	= 2.21	DRAFT AFT : $11.75 - \left(\frac{23.41}{63} \times 34\right)$	= 11.14'.
KGf	= 11.10	DRAFT FORD : $11.75 + \left(\frac{33.72}{63} \times 34\right)$	= 12.48'.
M.C.T. 1 INCH	= 14.24 FT.	ASSUMED 'X' CURVES DBL.	= Zero.

$GZ_f = KN - KG_f \sin \phi^\circ.$

ANGLE OF HEEL ϕ°	0°	10°	20°	30°	40°	50°	60°	-
KN '	-	0.2212	4.0203	5.9162	7.4676	8.6264	9.4854	-
$\sin \phi^\circ$ '	0	0.1730	0.3420	0.5000	0.6428	0.7660	0.8660	-
$K_f G_f \sin \phi^\circ$ '	(-) 0	(+) 1.9269	(+) 3.7962	(+) 5.5838	(+) 7.1851	(+) 8.5036	(+) 9.6126	-
GZ_f '	0	0.3543	0.4121	0.3562	0.2825	0.1618	0.0728	-



ϕ°	GZ_f	S_m	f.	S_m	f.
0°	0	1	0	1	0
10°	0.3543	3	1.0629	4	1.4172
20°	0.4121	2	0.8242	2	0.8242
30°	0.3562	1	0.3562	4	1.4248
40°	0.2825			1	0.2825
			2.6554		4.0287

AREA INTO 30°: $\frac{10}{3} \times 10 \times 2.6554$ = 9.958 Ft°

AREA 30° TO 40°: $\frac{10}{3} \times 10 \times 4.0287$ = 13.402 Ft°

AREA 30°: 40° = 13.402 − 9.958 = 3.444 Ft°

AXIOM
MARINE CASUALTIES
INVESTIGATIONS

CONDITION N° 3 DATE:-

S.E.V. 'SAMWISE'

LOADING CONDITION AT TIME OF CASUALTY, WITH FORWARD HOLDS FILLED.
(PLUS NOMINAL 3% MOTOR SHIPPED ON DECK ETC.)

ITEM.	WT. (TONS)	VCG. (FT)	V. MT. (FT T)	LCG (FT ±)	L. MT. MOMENT (FT)	L. MT. ARM. (-)	F.S. (FT²)
LIGHTSHIP (1987).	140·47	11·81	1658·54	4·04 F	563·75		-
O.F. (P.S) STOW - FR 1. (98%)	11·42	11·90	135·90	29·20 -		333·17	520
O.F. (P.S) FR 1 - FR 3 (78%)	7·10	9·80	69·58	24·90 -		176·79	340
O.F. (P.S) FR 19 - FR 21 (78%)	5·63	5·70	32·09	17·00 F	67·56		40
H.O. } MILLSTONE "LOUISVILLE" LOW	-	-	-	-	-	-	
L.O. } P.S.B. & EXCHANGERS.	-	-	-	-	-	-	
F.W. FR 25 - FR 28 (P.S) (95%)	5·08	7·40	37·59	23·75 F	120·65		170
FIR TRICES	0·10	7·00	0·70	5·00 F	1·50		-
TOWING TRICES	0·10	1·50	0·15	6·00 -		0·60	-
CREW & EFFECTS	0·90	17·00	15·30	21·00 F	18·90		-
STORES	1·00	15·00	15·00	14·00 F	14·00		-
WASTE DRAINS OVER (W.V. OK) TANK TOP	0·20	10·60	2·90	13·0 -		2·60	-
- - - (OTHER DK)	0·10	22·30	2·25	5·00 F	0·50		-
FORWARD HOLDS (P.S) (Bulk) (ICE)	54·86	8·20	449·85	1·10 F	60·34		-
AFT HOLDS (P.S) BULK - 5000 lbs/ft	13·39	8·50	113·81	14·0 -		187·46	-
28" ϕ TRAYS (Cu) AT 'A' } each 0·58 tons	1·52	15·65	23·64	2·0 F	3·00		-
- - (Fe) AT 'B' } total	0·26	17·35	4·51	11·0 -		2·86	-
- - (Cu) AT 'C' } (3·20)	0·92	16·83	82·80	22·0 -		198·24	-
- - (Cu) AT 'D'	1·55	17·67	27·39	31·0 -		48·05	-
28" ϕ TRAYS (117) AT E AT 7·60	3·66	16·65	60·94	7·00 -		25·62	-
7500 ft 1½" ϕ "MANILA" @ 0·676 cwt	2·14	18·10	32·74	18·0 -		38·52	-
2500 ft 1¾" ϕ "MANILA" @ 0·916 cwt	3·01	18·10	54·48	18·00 -		54·18	-
SPARE 1½" ϕ "MANILA" 2000 ft (@ 0·784)	0·44	21·25	3·44	30·0 F	4·20		-
17 MOORING BOARDS & CHOCKS	0·08	14·75	1·18	30·0 -		2·40	-
17 - - LINES (136 cwt)	0·10	14·75	1·47	30·0 -		3·00	-
2 @ 20 ft HOSES @ 10 lb/ft	0·12	15·00	1·80	30·0 -		3·60	-
18 @ 2 ft BUOYS @ 10 lb/ft.	2·07	22·50	1·57	30·0 F	2·40		-
"SUNDRY" WATER (23·85·0·036 ϕ/ft) =	1·40	14·28	19·96	28·50 -		39·90	862·0
(1·5 × 2·24 × 8·5 × 8·00 cwt) 12					318·90	1122·99	9760
SUMMATION :-	259·38	10·99	2849·69	0·83 A.	214·19 ft		259·15·3 = 140·3

JX/A
MARINE CASUALTY.
INVESTIGATIONS.

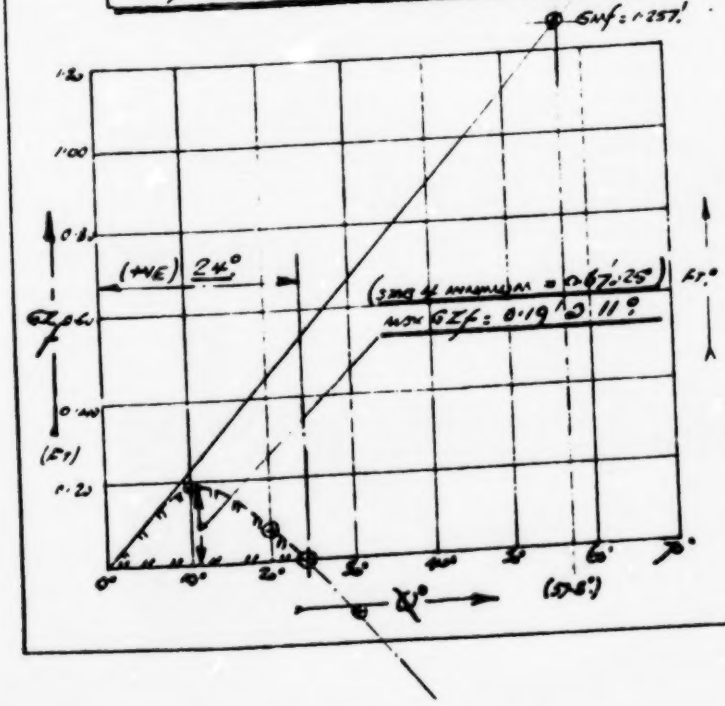
CONVICTION No:- 3. DATE.

S.F.V. "SAMWISE"

NEW DRAFTS	259.35 Δ SW	= 11.80	LCB	= 1.57 A.
KMT		= 13.320	LCG	= 0.83 A.
KG		= 10.988	'G' to 'B'	= 0.74 F
GMS		= 2.332	TRIM :- $\frac{259.35 \times 0.74}{14.30 \times 12}$	= 1.12 F
F.S. CORRECTION		= −1.075	LCF	= 2.80 A
∴ GMf		= 1.257	DRAFT AFT = $11.80 - \left(\frac{3.70}{65} \times 1.12\right)$	= 11.29'
KGf		= 12.063	DRAFT FORD = $11.80 + \left(\frac{3.53}{65} \times 1.12\right)$	= 12.41'
MCT 1 INCH		= 14.30 T.F.	ASSUMED 'X' CURVES ∴ B/L	= Trim.

$GZ_f = KN - KG_f \sin \phi^\circ$.

ANGLE OF HEEL ϕ°		0°	10°	20°	30°	40°	50°	60°	-
KN	=	-	2.2800	4.2400	5.8950	7.4750	8.8510	9.8750	-
$\sin \phi^\circ$	=	0	0.1736	0.3420	0.5000	0.6428	0.7660	0.8660	-
$KG_f \sin \phi^\circ$	=	(-) 0	(+) 2.0914	(+) 4.1255	−6.0315	(−) 7.7502	—	—	-
GZ_f	=	0	(+) 0.1839	(+) 0.0745	(−) 0.1365	(−) 0.2752	—	—	-

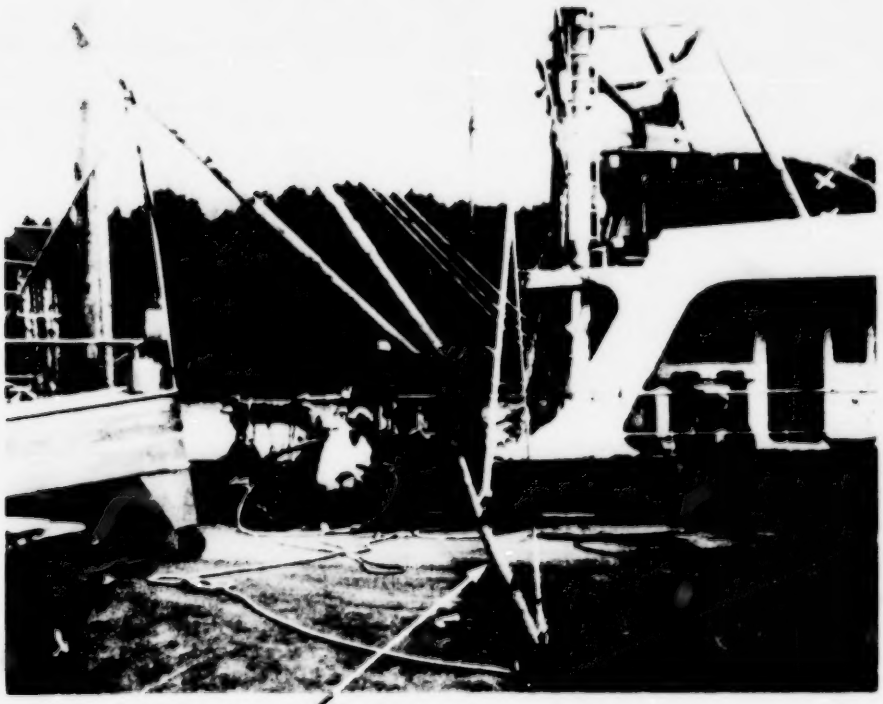


φ	GZ_f	S/m	f.	S/m	f.
0°	0	1	0	1	
8°	0.1780	3	0.5160	4	
16°	CURVED.	3	0.4284	2	
24°	0	1	0	4	
				1	
			0.9360		

AREA UNDER 24°: $\frac{3}{8} \times 24 \times 0.936 =$ 2.808 Ft (TOTAL).

Survival suit used by crew member.

Combinaison de survie enfilée par le membre d'équipage.



Stabilizer pole

Bras stabilisateur